

SURVEY ON POSTHARVEST PRACTICES AND LOSSES OF BANANA IN SELECTED AREAS OF BANGLADESH

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Abstract

A study was conducted to analyze the postharvest practices and losses of banana during November 2008 to June 2009. Six districts including two urban areas were selected for the study. Some indigenous post harvest practices were observed where banana was covered with banana leaves and kept under the shade of trees. The usual packaging practices were mainly bamboo made baskets lining with banana leaves and covering with gunny sheets at retailers' level. None of the arathdars was involved in packaging. The postharvest losses were reported mainly at harvesting (2.13%), handling from orchard to selling point by the growers and beparies involved in harvesting as well as short distance beparies (2.75 %), handling from selling point to distant market as well as long distance beparies (9.0), arathdars level (7.25%), retailers level (3.0%) and after buying by the consumers (2.5%). The gross post harvest losses from harvesting to consumption of banana were calculated as 26.63%.

Introduction

Banana (*Musa sapientum* L) is one of the major fruit crops in Bangladesh in respect of production and area (BBS, 2006). It is available through out the year and consumption rate is higher than any other fruit. It is one of the cheapest, delicious and most nourishing of all fruits. The origin of banana is southern part of China (Bose, 1985). The fruit is widely grown in sub-tropical Asia and has been successfully cultivated in Hawaii and South Africa (Scott, *et al.*, 1982). Banana is grown in 1681 hectares of land and its production is 40195 MT in Bangladesh (BBS, 2006). Banana is a highly perishable fruit. The perish ability of the fruit is attributed to immense physiological changes after harvest (Momen *et al.* 1993).

Banana is susceptible to disease infestation causing post-harvest losses due to lack of proper pre-harvest and postharvest management practices. Banana has a short shelf life and vulnerable to environmental stress especially high temperature. A considerable amount of banana fruit losses occur every year during harvesting, sorting, storing, transportation, and selling. However, very little information is available on the postharvest practices and losses of banana at growers, beparies, pikars, arathdars, retailer and consumers' levels. The results of this study will provide valuable information on the practices and losses of banana, which will help to carry out future research plan for developing appropriate postharvest practices to reduce postharvest losses of banana. With this view in mind, the present study was been undertaken to analyze the existing postharvest practices and losses of banana at different levels like growers, beparies (long and short distance), arathdars, retailers and consumers' level.

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Materials and Methods

Sample size and population

Four levels viz., growers, arathdars, beparis, and retailers were selected from eight banana growing areas namely, Jhenaidah, Jeesore, Kustia, Gaibandha, Joypurhat, Tangail (Madhupur), Gazipur, Narsingdi for getting answers to research questions by using pre-tested questionnaires. These initial respondents were randomly selected from a list of retailers. Beparies were selected based on the list of names provided by the retailers interviewed. Arathdars and growers were selected based on the list of names provided by the beparies and retailers. Consumers were selected from two urban areas namely; Gazipur and Dhaka city based on the response of respondents or retailers. Ten respondents were randomly selected for each level (growers, beparies, arathdars, retailers and consumers) and location and it was replicated for three times. Thus the total sample size and populations were: 10 respondents X 4 levels X 8 banana growing areas X 3 replications + 10 respondents X 2 urban areas X 3 replications = 1020 numbers (Table 1). Data regarding postharvest practices and losses with other relevant factors were collected from growers, beparies, arathdars, retailers and consumers in the above regions during the study periods of November 2008 to June 2009.

Table 1. Overview of sample size and population

Name of crop	Sample size by agent		Sample size by district		Total
Banana	Level	Respondents	Growing area	Respondents	
	Growers'	240	Jhenaidah	120	120
	Beparies'	240	Jessore	120	120
	Arathdars'	240	Kustia	120	120
	Retailers	240	Gaibandha	120	120
	-	-	Joypurhat	120	120
	-	-	Tangail (Madhupur)	120	120
	-	-	Gazipur	120	120
	-	-	Narsingdi	120	120
	Consumers'	60	Dhaka	30	30
		Gazipur	30	30	
Total		1020		1020	1020

Definition of (6) channels

Growers: Growers produces banana and sold their produce to the bepari through arathdar. Sometimes, they sold their garden to the bepari directly.

Bepari: There are two kinds of beparies: local or coming from other districts like Dhaka, Chittagong, Khulna, Jessore, Barisal etc. They bought harvested banana from growers and pikars in the local markets through the local arathdars. The second group of the beparies bought banana orchards directly from the growers or other intermediates, harvest banana fruits by their own management and sell banana to the arathdars operating in the local market or dispatch it to arathdars to other big markets.

Arathdar: Arathdars are big traders. They are commission agents and have a fixed establishment in the market and operated between beparies and retailers. They took commission from growers and beparies.

Retailer: Retailer is the last link in the banana selling. Retailers were found to operate with permanent shops in the banana growing and urban areas. They mostly bought banana from the

beparies through arathdar and sell it to the local or urban market and sometimes in urban residents, the ultimate consumers.

Consumer: The people who bought banana from retailers with their requirement for consumption are known as consumer. They are the last respondent group of this survey.

Results and Discussion

Varieties

It was found that growers at different locations cultivated four commercial cultivars of banana: Champa, Sagar, Sabri and Kabri. Champa was cultivated by 40% of the growers of all the districts except Gaibandha (45%), Tangail (10%) and Joypurhat (5%). Similarly Sabri was cultivated by 40% of the growers of Jhenaidah, Jessore and Kustia compared to 50% of the growers of Joypurhat and 30% of Gazipur and Narsingdi (Table 2). The majority of the growers (60%) of Tangail cultivated Sagar while 40% of the growers of Gaibanda and Joypurhat cultivated the same variety. Kabri was the least cultivated variety which ranged between 5 to 10% of the growers of all the selected locations.

Table 2. Location- wise and variety-wise distribution of banana growers

Variety	Varieties cultivated by growers (as percentage)							
	Jhenaidah	Jessore	Kustia	Gaibanda	Joypurhat	Tangail (Modhupur)	Gazipur	Narsingdi
Champa	40	40	40	45	5	10	40	40
Sagar	15	15	15	40	40	60	20	20
Sabri	40	40	40	10	50	20	30	30
Kabri	5	5	5	10	5	10	10	10

Identification of maturity and selection of harvesting stages

All the respondents in all the eight locations informed that fruit size, colour and fullness of finger were the selection criteria of maturity index of banana fruits. When the fruits attain full size, angularity and bears attractive colour, the growers or beparies get ready for harvesting. Eighty percent respondents in Jhenaidah, Jessore, Gaibandha, Joypurhat, Tangail (Modhupur) and seventy percent in Kustia and Gazipur and hundred percent in Narsingdi area mentioned that harvesting stage of banana was also determined by the upper and lower size of banana bunches. The respondents' opined that fruits harvested before getting fullness of finger or appearing colour was not suitable for marketing (Table 3).

Table 3. Criteria for maturity identification and selection of harvesting stage in different locations

Location	Basis of maturity Identification (%)			Harvesting stage based on different maturity criteria (%)		
	Fruit size	Colour	Fullness of finger	Angularity/fullness of finger	Size of upper and lower bunch	Colour
Jhenaidah	100	100	100	100	80	100
Jessore	100	100	80	100	80	100
Kustia	100	100	80	100	70	100
Gaibandha	100	100	100	100	80	100
Joypurhat	100	100	100	100	80	100
Modhupur	100	100	70	100	80	100
Gazipur	100	100	80	100	70	100
Narsingdi	100	100	100	100	100	100

Harvesting period and time of harvest on the day

It was reported by the respondents that harvesting period of the banana was from November to June in a year in all the eight locations Jhenaidah, Jessore, Kustia, Gaibandha, Joypurhat, Tangail (Modhupur), Gazipur and Narsingdi (Table 4). Most of the growers harvested banana in March to June based on fruit colour, angularity and size of upper and lower bunch.. Most harvesting was done in morning but sometimes performed late in the afternoon depending on the purpose of marketing or agreement to the beparies from distant location.

Table 4. Location- wise banana harvesting period and time of harvest on the day by the growers

Location	Harvesting period (% over total harvesting)				Time of harvest on the day (% of respondents)	
	Nov-Dec	Jan-Feb	March-April	May -June	Morning	Afternoon
Jhenaidah	10	5	45	40	70	30
Jessore	10	5	45	40	80	20
Kustia	10	5	45	40	70	30
Gaibandha	5	5	50	40	70	30
Joypurhat	10	5	45	40	80	20
Modhupur	10	30	30	30	70	30
Gazipur	15	20	35	30	80	20
Narsingdi	15	20	35	30	70	30

Postharvest practices

Some indigenous postharvest practices were observed in all the growing areas mostly by the growers and/or beparies who were involved in the harvesting process. These practices were banana covered with banana leaves before carrying to different places. Bepari were not practices in sorting and grading but arathdars involved with sorting and grading according to the upper and lower bunches of banana. Chemicals for insect control and ripening were practiced in selected areas. Most of the arathdars ripened banana by tundur, heaping and smoking treatments ((Table 5).

Mode of transportation

Means of transportation used mainly depends on the volume of produce handled and distance of the market from the growing area. Growers having small quantity of marketable banana generally used rickshawvan and nosimon whereas for large volume both growers and intermediaries (bepari) used van, nosimon, bus and truck for local and distant market respectively (Table 6).

Postharvest losses of banana

Losses during harvest: The losses of banana were estimated based on the responses of the respondents. The losses of banana during harvest were 4% in Gaibandha and Joypurhat while it was 2% in Jhenaidah, Jessore and Kustia and 1% in Gazipur, Modhupur and Narsingdi. On an average, 2.13% losses were occurred at growers' level during harvesting (Table 7). According to the growers' opinion, these losses were mostly due to disease and pest infestation at pre-harvest condition but expressed at harvesting period. They also opined that a small proportion of these losses also occurred due to adverse weather condition especially natural calamity, cultivar, inappropriate time of harvest, careless harvesting and handling practices. Madan and Ullasa (1990) reported that postharvest losses in banana depend largely on cultivar, time of harvest, mode of transport, handling practices, and peak marketing seasons in different regions.

Table 5. Postharvest techniques used by respondents of different locations

Particulars	Jhenaidah			Jessore			Kustia			Gaibandha		
	Gr.	Be.	Ar.	Re.	Gr.	Be.	Ar.	Re.	Gr.	Be.	Ar.	Re.
Covered with banana leaves	40	60	50	-	30	60	45	-	40	60	50	45
Sorting	-	-	70	-	-	-	70	-	-	-	-	60
Grading	-	-	60	-	-	-	60	-	-	-	-	50
Ripening method (Tundur, ripening agent, heaping etc.)	-	-	70	-	-	40	70	-	-	-	40	60
Chemicals (for colour development etc.)	20	-	-	-	20	-	-	-	20	-	-	-

Gr=Grower, Be= Bepari, Ar= Arathdar, Re= Retailer.

Table 5. (Cont'd.) Postharvest techniques used by respondents of different locations

Particulars	Tangail (Modhupur)			Joypurhat			Narsingdi			Gazipur		
	Gr.	Be.	Ar.	Re.	Gr.	Be.	Ar.	Re.	Gr.	Be.	Ar.	Re.
Covered with banana leaves	40	70	50	-	30	70	45	-	40	45	50	40
Sorting	-	-	70	-	-	-	70	-	-	-	-	80
Grading	-	-	60	-	-	-	40	-	-	-	-	30
Ripening method (Tundur, ripening agent, heaping etc.)	-	-	50	-	-	-	50	-	-	-	-	70
Chemicals (for colour development, insect and disease control etc.)	60	-	-	-	60	-	-	-	60	40	40	-

Table 6. Mode of transport from local selling point to distant market

Particulars	Percent of total respondents													
	Jhenaidah				Jessore				Kustia					
	HL	RV	AD.	BS.	TR.	HL.	RV.	NM.	BS.	TR.	HL.	RV.	NM.	BS.
Grower	10	45	45	-	-	10	40	50	-	-	10	55	35	-
Bepari	-	10	10	20	60	-	10	10	20	60	-	10	10	20
Arathdar	-	30	30	-	40	-	30	30	-	40	-	30	30	-
Retailer	10	40	45	5	-	10	40	45	5	-	10	40	45	5

Table 6 (Cont'd.) Mode of transport from local selling point to distant market

Particulars	Percent of total respondents													
	Gaibandha				Joypurhat				Modhupur					
	HL	RV	NM.	BS	TR	HL	RV	NM	BS	TR	HL	RV	NM	Pick-up
Grower	10	55	35	-	-	20	50	30	-	-	10	55	35	-
Bepari	-	10	10	-	80	-	10	10	-	80	-	10	10	20
Arathdar	-	60	-	10	30	-	60	30	5	5	-	60	40	-
Retailer	10	60	20	10	-	15	60	20	5	-	-	30	50	20

Table 6 (Cont'd.) Mode of transport from local selling point to distant market

Particulars	Percent of total respondents													
	Gazipur				Narsingdi									
	HL	RV	NM	BS	TR	HL	RV	NM	BS	TR	HL	RV	NM	Pick-up
Grower	10	55	35	-	-	20	55	25	-	-	-	-	-	-
Bepari	-	10	10	10	70	-	10	10	10	70	-	-	-	-
Arathdar	-	50	-	-	50	-	60	40	10	10	-	-	-	-
Retailer	20	50	30	-	-	20	50	30	-	-	-	-	-	-

HL=Head load, RV= RickshawVan*, AL= Alamdanga, NM=Nosimon**, BS= Bus,TR=Truck, Tri-cycle operated manually
**Nosimon-A local made tri-cycle operated by shallow-engine

Table 7. Proportion of postharvest losses of bananas at growers/beparies levels with respect to different phases/points of supply chain

supply chain		Percent losses															
		Growers/beparies involved in harvesting							Beparies not involved in harvesting								
		Jhenaidha	Jessore	Kustia	Gaibandha	Gazipur	Joydebpur	Modhupur	Narsingdi	Jhenaidha	Jessore	Kustia	Gaibandha	Gazipur	Joydebpur	Modhupur	Narsingdi
During harvesting		2.0	2.0	2.0*	4.0	1.0	4.0	1.0	1.0	-	3.0	3.0	4.0	1.0	4.0	2.0	2.0
Handling transport from harvest (orchard) to selling/loading point of local market																	
Total		2.0	2.0	2.0	4.0	1.0	4.0	1.0	1.0	3.0	3.0	3.0	4.0	1.0	4.0	2.0	2.0
Average		2.13							2.75								
During handling/transport from purchasing/loading point to point of delivery of goods	During transport	-	-	-	-	-	-	-	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	
	Loading distance	-	-	-	-	-	-	-	6.0	6.0	6.0	6.0	4.0	6.0	4.0	6.0	
	purchasing/loading	-	-	-	-	-	-	-	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	
	point to point of selling																
point pf distant market																	
	Total	-	-	-	-	-	-	-	10	10	10	10	6	10	8.0	8.0	
Average		-							9.0								

Losses during handling/transport from harvest (orchard) to selling point of local and distant market

On an average, 2.75% losses were occurred at beparies (short distance) level during handling or transport from orchard to the selling point in local market (Table 7.). Maximum losses of 4% occurred in Gaibandha and Joypurhat followed by 3% in Jhenaidha, Jessore and Kustia and 2% in Madhupur and Narsingdi. The lowest loss of 1% occurred in Gazipur which might be occurred due to its short distance compared to other selected districts of Bangladesh. The average loss during loading of banana was 2% in all the locations while it was only 1% in Gazipur and Narsingdi. The lowest losses in Gazipur and Narsingdi might be occurred due to its short distance from Dhaka city compared to others. The maximum loss of 6% occurred during transportation of banana in all the locations where the loss of 4% occurred in Gazipur and Madhupur. Some losses were also observed during delivery of banana and it was estimated at 2% in most locations. Thus on an average, 9.0% postharvest losses were occurred at beparies (long distance) level (Table 7). They reported that these losses might be due to careless handling, transporting mode, delayed transportation due to unavoidable reasons and over loading tendency. The similar findings were also found by Madan and Ullasa (1990).

Losses at arathdars level: The average losses of banana were 8.0, 8.0., 8.0, 10.0, 6.0., 10.0, 8.0. and 7.0% at the arathdars level in Jhenaidah, Jessore, Kustia, Gaibandha, Gazipur, Joypurhat, Modhupur and Narsingdi, respectively. On an average, 7.25% losses occurred at arathdars level. They opined that these losses might be due to over heating, lack of marketing and storage facilities of banana (Table 8.).

Table 8. Proportion of postharvest losses of bananas at arathdars levels

Level of losses	Percent losses							
	Jhenaida	Jessore	Kustia	Gaibandha	Gazipur	Joypurhat	Tangail (Modhupur)	Narsingdi
From ripening to selling point	8.0	8.0	8.0	10.0	6.0	10.0	8.0	7.0
Average	7.25							

Table 9. Proportion of postharvest losses of bananas at retailers and consumers levels

Level of losses	Percent losses									
	Retailer								Consumer	
	Jhenaida	Jessore	Kustia	Gaibandha	Gazipur	Joypurhat	Modhupur	Narsingdi	Dhaka	Gazipur
During harvest	-	-	-	-	-	-	-	-	-	-
Handling/transport from orchard to selling point of local market	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-	-
Cracking	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Rotting	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0
Total	3.0	3.0	3.0	4.0	3.0	3.0	3.0	3.0	3.0	2.0
Average	3.0								2.5	

Losses at retailers' level and after buying to consumption: It was observed that 3.0, 3.0, 3.0, 4.0, 3.0, 3.0, 3.0 and 3.0% losses were found at retailers' level in Jhenaidah, Jessore, Kustia, Gaibandha, Gazipur, Joypurhat, Modhupur and Narsingdi. It was also noted that 3.0 and 2.0% losses of banana were found at the level of consumers in Dhaka and Gazipur areas. On an average, 2.5 and 3.0% losses of banana were found at consumers' and retailers level in selected areas (Table 9). They reported that these losses might be occurred due to facing fruit broken and

rotten problem during handling and marketing. Similar observation was made by Madan and Ullasa (1990).

Conclusion

Some locally adopted postharvest practices were found to be followed by different points in banana supply chain. The usual postharvest practices followed by the growers and/or beparies were banana covered with banana leaves before carrying to different places. Beparies were not involved with sorting and grading of banana but mainly followed at arathdars level based on upper and lower bunches of banana. Both short and long distance losses of banana at beparies level was mainly due to rough handling, overloading tendency and delayed transportation due to unavoidable reasons. The postharvest loss of banana at arathdars level was due to overheating, inadequate marketing and storage facilities. The loss of retailers' level was mainly unused of lining material during transport of banana from arath or collecting point to selling point and unfavourable road condition in some selected areas. Postharvest losses of banana were recorded as 2.13% at growers level, 11.75% at beparies level (short distance beparies 2.75 and long distance beparies 9.0%), 7.25% at arathdars level, 3.0% at retailers and 2.5% at consumers level. Therefore, the gross post harvest losses from harvesting to consumption of banana were calculated as 26.63%. These losses may be minimized through improved postharvest practices like proper harvesting stage, proper method of pre-cooling, sorting of infested and damaged banana, grading on the basis maturity, size and shape and washing with clean/ chlorinated water before shipment to different places. Before loading and unloading, the banana should be handled carefully by the labour and other persons who are involved with banana storage and marketing. Standard packaging size and avoiding overloading tendency from collecting point to destination market may be other important tools to minimize the postharvest losses of banana.

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